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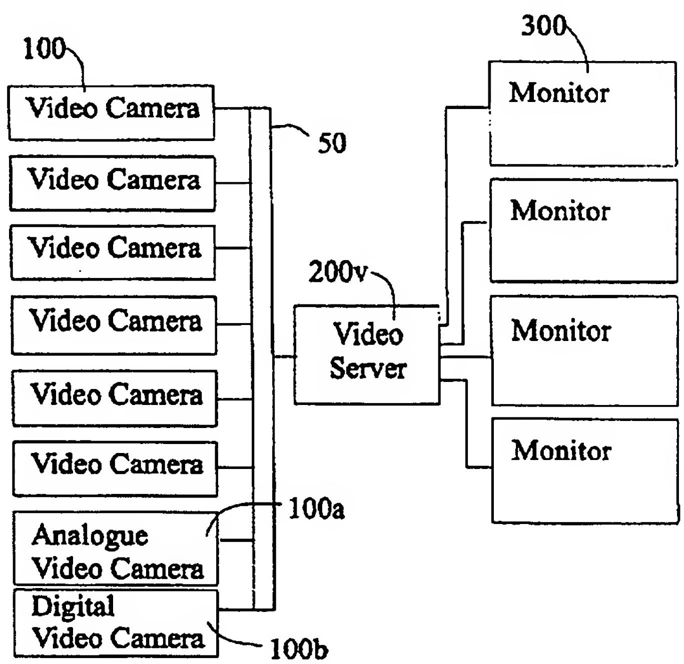
(54) **APPAREIL D'ENTREE A UTILISER AVEC DES RESEAUX NUMERIQUES**

(54) **INPUT DEVICE FOR USE WITH DIGITAL NETWORKS**



(57) L'invention porte sur un système de saisie d'images dans lequel de nombreuses caméras sont raccordées directement au réseau Internet et un système de surveillance comprenant un clavier et plusieurs contrôleurs est capable d'inviter successivement plusieurs caméras vidéo à émettre afin de recevoir les images qu'elles ont capturées. Les caméras sont équipées d'un processeur qui analyse les images capturées et transmet au système de surveillance les données déterminées à partir de ces analyses.

(57) An image capture system is disclosed wherein a plurality of video cameras are coupled directly to an Ethernet network and a monitoring system having a keyboard and several monitors is capable of polling the video cameras to receive images the video cameras have captured. The cameras are provided with processors for analysing captured images and for transmitting data determined from the analyses to the monitoring system.

Abstract of the Invention

An image capture system is disclosed wherein a plurality of video cameras are coupled directly to an Ethernet network and a monitoring system having a keyboard and several monitors is capable of polling the video cameras to receive images the video cameras have captured. The cameras are provided with processors for analysing captured images and for transmitting data determined from the analyses to the monitoring system.

Input device for use with Digital Networks

Field of the Invention

This invention relates generally to video surveillance systems and more particularly relates to a video surveillance system using an Ethernet network for communications.

Background of the Invention

In a common video surveillance system for installation in a building or group of buildings, a number of video cameras are disposed at predetermined locations within the building(s). At these locations, cabling exists for carrying the video signals to a central monitoring location. When cabling is not present, new cables must be installed, the cost of which is often significant. This usually deters moving video cameras within an existing building.

Once the video cameras and associated cabling are installed, a central security monitoring area is designated. Therein is installed a plurality of monitors and analogue switch boxes that allow for viewing of a plurality of different areas simultaneously. One monitor is capable of showing video images from any of a number of cameras. Video recording apparatuses are installed so as to capture signals as desired.

Existing video surveillance systems are very effective. They replace a large number of security personnel with a smaller more centralised security staff equipped with wireless communications devices communicating with the central security monitoring area. The use of video recording apparatuses is helpful in examining events after they have occurred.

For example, in a casino, monitoring of patrons and employees for undesirable activity is considered essential. A video camera placed above each table allows for monitoring of players and employees. Electronic representation of the images are transmitted to one or more monitoring systems where security staff monitor the images to

identify emergency and other concerns. Concurrent with the display and monitoring of the images, recording of video images is performed for later analysis. At the end of a predetermined period of time, for example a day or a week, or when something appears amiss a careful review of the captured video images allows for a detection of any undesirable activity.

In the technology industry, for example integrated circuit (IC) fabrication facilities, very small very expensive parts are manufactured, tested, and packaged. Recently, theft of these parts has become commonplace. Unfortunately, technological industry changes frequently and requires a flexible system for monitoring and preventing theft or other undesirable activities. Coaxial cables and video cameras are not easily moved every time a machine or assembly line relocates or is rearranged.

A field that has experienced considerable growth over the past few years is the field of video conferencing. Extremely expensive proprietary systems of years ago, have been replaced by portable, inexpensive "off the shelf" video capture devices connected to personal computers. Two examples of such devices are discussed below. For a UNIX workstation produced by Sun Microsystems®, a digital camera is available, analogous to a video camera without a recording apparatus, and associated software. The software compresses the video signal and displays it on a monitor. The compressed file is also transmissible across a digital computer network for display on another computer of a similar type. Bi-directional transmission of video information and audio information provides video conferencing. Alternatively, small video clips can be stored on a computer and transferred as a video file to another computer for viewing at a later time.

A similar system, available for use with Macintosh® computers and IBM® compatible personal computers, is produced by Connectix® under the brand name QuickCam®. The features supported by the QuickCam® are also image capture and compression for storage and transmission.

A significant advantage of both the above mentioned systems is that they use existing data communications cabling within a business. Ethernet, a common data

communications protocol, is a system that is easily installed and for which cable drops are easily added or removed. Unlike coaxial cables that are installed from a location to a central monitoring location for each video camera, Ethernet cabling connecting data networks of computers carries data from a plurality of computers over a single physical cable.

Though, the above video products are inexpensive when a computer already exists on a users desktop, acquiring a video capture device and a computer is costly. Further, the performance requirements for real time processing of video signals is still prohibitive. Finally, connecting a video capture device to computers being used by employees, reduces performance of the computer and may adversely effect productivity.

There are known peripherals for connection to digital communication networks. These peripherals include printers. Printers are output peripheral devices and as such are easily installed on a digital communication network. Data transmitted to a network printer, is printed by the printer. Though output devices are easily connected to digital communication networks, input devices do not afford a same simplicity. To that end, input devices are not commonly attached to digital communication networks unless an output device is included as part of the input device. Examples of such devices include personal computers.

It would be advantageous to provide an image input system that is easily installed, modified, and expanded.

Object of the Invention

It is an object of this invention to provide a video surveillance system that uses data communication paths for transmission of video signals.

It is a further object of the invention to provide a video surveillance system that requires reduced bandwidth for data transmission.

Statement of the Invention

In accordance with the invention there is provided an imaging input system for use with a digital communication network supporting a digital communication protocol, the digital network for simultaneous connection to a plurality of computers, the system comprising an imaging input device, the device comprising:

means for capturing images and for providing digital representations of the images;

means for receiving the digital representations of the images and for processing some of the digital representations to provide data in dependence thereon; and having a single digital data output port comprising a dedicated means unassisted by a personal computer, for providing some of the data to the digital communications network using the digital communication protocol

In an embodiment, the imaging input device comprises a single housing and wherein the entire imaging input device is housed within said single housing.

In an embodiment the only digital data interface to the surveillance camera is the digital communication network.

In accordance with the invention there is provided an imaging input system for use with a digital communication network supporting a digital communication protocol, the digital network for simultaneous connection to a plurality of computers, the system comprising: an image input device comprising:

means for capturing images and for providing digital representations of the images;

means for receiving the digital representations of the images and for processing some of the digital representations of the captured images to provide data in dependence thereon consisting of at least a processor, non-volatile memory, volatile memory, and means for

providing some of the data to the digital communications network using the digital communication protocol.

In accordance with the invention there is provided an imaging input system for use with a digital communication network supporting a digital communication protocol, the digital network for simultaneous connection to a plurality of computers, the system comprising:

an image input device comprising:

a housing;

means, disposed within the housing, for capturing images and for providing digital representations of the images;

means, disposed within the housing, for receiving the digital representations of the images and for processing some of the digital representations to provide data in dependence thereon; and

means, disposed within the housing, for providing a compressed digital video output signal of some of the data to the digital communications network using the digital communication protocol.

In accordance with the invention there is provided a method of capturing images for use with a digital communication network, the method comprising the steps of:

capturing images using image capture means disposed in different locations;

providing digital representations of the captured images to a processor;

processing the digital representations of the images using the processor;

transmitting the processed digital representations of the images to a monitoring system using a digital communication protocol supported by the digital communication network coupled between the image capture means and the monitoring system;

receiving the digital representations of the images at the monitoring system and alternately displaying images from different video cameras on a monitor coupled to the video server.

It is an advantage of the present invention that a single input system for use with a digital communication network and absent an output device or an attached personal computer is shareable among a plurality of computer systems.

Brief Description of the Drawings

An exemplary embodiment of the invention will now be described in conjunction with the attached drawings, in which:

Fig. 1 is a simplified block diagram of a video surveillance system according to the prior art;

Fig. 2 is a simplified block diagram of a video surveillance system according to the invention;

Fig. 3 is a method according to the invention for performing video surveillance across a digital network having a limited bandwidth;

Fig. 4 is another method according to the invention of performing video surveillance across a digital network having a limited bandwidth;

Fig. 5 is a simplified flow diagram of a method of selecting image frames captured by a camera for transmission via a digital network;

Fig. 6a is a simplified flow diagram of another method of performing video surveillance across a digital network having a limited bandwidth;

Fig. 6b is a simplified flow diagram of another method of performing video surveillance across a digital network having a limited bandwidth;

Fig. 7 is a simplified flow diagram of a method of polling surveillance cameras for video surveillance via a digital network according to the invention;

Fig. 8 is a simplified flow diagram of a method of limiting bandwidth required to perform video surveillance via a digital network wherein each camera analyses images and transmits to a video server a value in dependence upon the analyses;

Fig. 9 is a simplified flow diagram of a method of polling cameras in a video surveillance system incorporating the method shown in Fig. 8;

Fig. 10a is a simplified block diagram of a surveillance camera according to the invention;

Fig. 10b is a simplified block diagram of a surveillance camera system according to the invention;

Fig. 11 is a simplified diagram of a plurality of computers and peripherals in communication via a digital communication network;

Fig. 12 is a simplified flow diagram of a method of user identification using an input imaging system according to the invention;

Fig. 13 is a simplified flow diagram of a method of user identification for actuating a door lock mechanism using an input imaging system according to the invention;

Fig. 14 is a simplified flow diagram of a method of user identification ufor providing system access sing an input imaging system according to the invention;

Fig. 15 is a simplified flow diagram of a method of user identification for implementing security measures for print outs using an input imaging system according to the invention;

Fig. 16 is a simplified flow diagram of a method of user identification for implementing security measures for print outs using an input imaging system according to the invention;

Fig. 17 is a simplified diagram of a plurality of computers and peripherals in communication via a digital communication network;

Fig. 18 is a simplified plan view of a building;

Fig. 19 is a simplified view of a biometric imaging device for use with the present invention;

Fig. 20 is a simplified view of a printer provided with a biometric imaging device for use with the present invention; and,

Fig. 21 is a simplified view of a telephone provided with a biometric imaging device for use with the present invention.

Detailed Description

In video surveillance, it is often desirable to move a video camera around an area over time in order to alter investigation parameters or in order to narrow an area of surveillance. It is also desirable to increase a number of video capture devices in problem areas or for certain functions. Some examples of functions that are significant include visits by high profile individuals, open houses, etc. As described above, existing video

surveillance systems require significant effort in relocating video cameras and in installing new video sources.

Referring to Fig. 1, a high level block diagram of a video surveillance system according to the prior art is shown. A plurality of video capture means in the form of video cameras 1 are disposed in different locations. From each video camera 1 a cable in the form of a coaxial cable extends to a switching system 2. Commonly, switching systems 2 are provided with timing control systems 4 as shown. The timing control system 4 switches between different camera signals automatically in a first mode and allows manual switching between video camera signals in a second mode. Many currently available switching and monitoring systems are computer controlled. As shown in Fig. 1, a plurality of monitors 3 each receive a signal from the switching system 2 allowing for viewing of any of a number of signals from the video cameras 1.

During installation, a cable is installed from each camera location to a central switching system location or to distributed switching system locations. Unfortunately, flexibility and relocatability of cameras 1 is greatly reduced using such a system.

Referring to Fig. 2, a high level block diagram of a video surveillance system according to the invention is shown. A digital communications network 50 is installed within a building. Commonly, such a digital network already exists within a building. Digital communications networks are well known in computer communications and telecommunications. Some examples of digital communication networks include Ethernet, Appletalk, Sonnet, ATM, and switched Ethernet. A monitoring system in the form of a video server 200v is coupled to the network 50. Coupling to digital communication networks is often provided through an adapter card (not shown). It is apparent to those of skill in the art that such an adapter is commonly incorporated into the central monitoring system 200v and the video cameras 100.

In the embodiment of Fig. 2, the central monitoring system 200v is in the form of an IBM® PC compatible computer provided with a plurality of monitors 300 and an Ethernet adapter board (not shown). The digital communication network 50 is an Ethernet

communications network. For timing, a timing source within the computer in the form of a real time clock is used.

A plurality of imaging input devices in the form of video cameras 100 are disposed throughout a building, each coupled to the digital communication network 50. There are many methods of achieving the connection. In an embodiment, the video cameras 100 are designed with an embedded processor and an Ethernet adapter. An Ethernet connector cable is directly coupled to the Ethernet adapter within the camera. Of course, for other digital networks other adapters are used. In this embodiment, due to the limitation of bandwidth over an Ethernet communication network, every pixel from every frame from every camera is not transmitted. Each camera 100 captures and digitises images on an ongoing basis but only transmits a portion of digital representations of the images to the central monitoring system 200v. Alternatively, each camera 100 captures and digitises images on an ongoing basis but only transmits digital representations of the images when a request from the central monitoring system 200v is received. Further alternatively, image capture and transmission is only performed when a request for such is initiated by the central monitoring system 200v.

Referring to Fig. 3 a simplified flow diagram of a method according to the invention is shown. An imaging input means in the form of a video camera 100 captures an image. The image is digitised. Frame grabbers for performing the digitising are well known. Of course, when a digital camera is used, the use of frame grabbers is obviated. The digital representation in the form of a digitised image or a portion thereof is then compared to previous digital representation. Many methods of image comparison are applicable and within the scope of the invention. Several are set out below. When the digital representations are substantially similar - when the new digitised image has substantially no new information over a previous image - no digital representation is provided to the monitoring system 200v via the digital network 50.

According to the invention, a video camera 100 typically operates as follows: an image is captured, a digital representation of the image is analysed for changes from a

previous image; when changes have not occurred, further images are captured; when changes have occurred the digital representation is compressed and the video camera 100 awaits a request from the monitoring station 200v for a digital representation of an image; when a request for a digital representation of an image is received, the video camera 100 transmits either a signal indicative of no change or a compressed digital representation of the image. Of course, image throughput is limited by available bandwidth.

In a further embodiment, typical operation of a video camera 100 is as follows: an image is captured, a digital representation of the image is analysed for changes from a previous digital representation; when changes have not occurred, further images are captured; when changes have occurred the digital representation of the image is compressed and transmitted via the digital network to a video server.

Referring to Fig. 4, another method according to the invention of performing video surveillance is shown. An image captured with an image capture device in the form of a digital camera and a digital representation of an image in the form of an image frame is provided. When an analogue video camera 100a is used, the image is captured and digitised to form a digital image frame. When a digital video camera 100b is used, the image data from the digital video camera 100b is in the form of an image frame. A predetermined portion of the image frame is compared to a predetermined portion of a previous image frame. When the video camera 100 is mounted in fixed relation to its surroundings, the predetermined portions are a same portion. When the video camera 100 is movably mounted, the predetermined portions are comparable portions. When the image frames are of substantially same images, no image frame is transmitted through the digital network 50. When a substantial difference between image frames is detected, the latest captured image frame is provided to the digital network for transmission to the monitoring station in the form of a video server 200v.

Referring to Fig. 5, another method according to the invention of performing video surveillance is shown. A frame counter is reset. An image captured with an image capture device in the form of a digital camera, a digital representation of an image in the form of an

image frame is provided, and the frame counter is incremented. When the frame counter reaches a predetermined number, a frame is transmitted via the digital network 50 to the monitoring station 200v and the counter is reset. Alternatively, a predetermined portion of the frame is compared to a predetermined portion of a previous frame. When the images are substantially same images, no image frame is transmitted via the digital network 50. When a substantial difference between image frames is detected, the latest captured image frame is provided to the digital network 50 for transmission to a monitoring station in the form of a video server 200v. Optionally, when the image frame is transmitted to the video server 200v, the frame counter is reset.

Referring to Fig. 6a, a simplified flow chart of a further embodiment according to the invention is shown. An imaging input device in the form of a video camera 100 captures and stores video images in an analogue or in a digital fashion in non-volatile memory. When captured and stored as analogue representations of images, the representations are then digitised to form digital representations of images in the form of image frames. A portion of a current digital image frame is compared to a portion of a previous digital image frame. When the portions are substantially similar, further images are captured. When the portions are sufficiently dissimilar, index information relating to the current digital image frame is stored and the current digital image frame is transmitted to a monitoring station in the form of a video server 200v. Optionally, the indexing information is transmitted with the digital image frame.

Referring to Fig. 6b, a simplified flow chart of a further embodiment according to the invention is shown. An imaging input device in the form of a video camera 100 captures images, stores representations of images in an analogue or a digital fashion in non-volatile memory, and provides a digital representation of the stored images. A portion of a current digital image frame is compared to a portion of a previous digital image frame. When the portions are substantially similar, further images are captured. When the portions are sufficiently different, index information relating to the current digital image frame is transmitted to the video server 200v. Preferably, the current digital image frame is stored in a retrievable location associated with the index information for retrieval upon receipt of a

request from the video server 200v for the image frame and for transmission to the video server 200v upon retrieval.

The invention is applicable to use with high speed digital networks. The preferred bandwidth of the digital network is determined in dependence upon a type of surveillance, amount of on demand bandwidth desired, a number of cameras, and an amount of network traffic attributed to other network traffic sources.

In accordance with the invention, a plurality of video cameras 100 are coupled directly to the digital network 50. It is evident to those of skill in the art that a direct connection is achievable through the use of a video capture device having incorporated therein a digital network access card and a processor or, alternatively, using a known video camera and an adapter external thereto for coupling between the camera and the digital network and for providing the desired functionality. Each video camera 100 provides digital image frames to the digital network 50 at intervals. The intervals need not be regular or same intervals. For example, a video camera at a predetermined location provides every second image frame captured to the digital network 50 and other cameras each provide every eighth image frame captured to the digital network 50, thereby accommodating 5 video cameras 100 on a digital network 50 having sufficient bandwidth to support a video signal from a single video camera 100.

Referring to Fig. 7, a simplified flow diagram of a method of polling video cameras on a digital network is shown. Each camera is associated with an time-slot. A timer in the form of a real time counter counts time. When the time is associated with a camera time slot occurs, a camera associated with that time-slot is polled. Of course, many systems exist for time-sharing or other resource allocation that are applicable to polling as used in the present invention.

Referring to Fig. 8, a simplified flow diagram of a method wherein digital representations of images are weighted and the most weighty digital representations are transmitted. Each video camera 100 captures an image and analyses a digital representations of the image for predetermined indicators. Examples of indicators are changes from a last

transmitted digital representation, visibility of predetermined markers within a digital representations of the image, etc. Each video camera 100 transmits a value determined in dependence upon the analysis to a central monitoring system 200v. The central monitoring system 200v determines a video camera 100 or a plurality of video cameras 100 from which to request a digital representations of an image. Upon receiving a request, a video camera 100 transmits the weighted image to the central monitoring system 200v. In such a fashion, high priority images are automatically displayed or recorded at the central monitoring location in dependence upon an indicator other than time.

Referring to Fig. 9, a method wherein digital representations of images are transmitted at regular intervals according to a polling or time sharing method outlined above has incorporated therein a method of analysing the digital representations of images to determine weightings therefore. When weighted digital representations are requested, other digital bandwidth than that allocated to the video monitoring system is used to transmit the requested digital representations. According to the flow diagram of Fig. 9, each camera transmits a digital representation of an image or a plurality of successive images at predetermined intervals. Each frame that is not already sent to the central monitoring system is analysed. Of course, those frames transmitted may be analysed as well. Values determined in dependence upon the analyses are transmitted to the central monitoring system 200v and an individual or a computer algorithm determines whether or not to request a particular weighted image. A simple algorithm for making the determination is a threshold algorithm where weightings above a threshold T result in a request and weightings below the threshold T do not so result. When requested, the weighted image frame is transmitted via data bandwidth on the digital network other than that allocated for the video surveillance system's normal operation.

In operation, the use of an extra monitor with the monitoring system allows images having a greatest significance to be displayed on the extra monitor while images from the surveillance cameras received according to a predetermined pattern of polling are displayed and/or recorded.

It is evident to those of skill in the art that computers and an imaging input system as taught herein can share a single digital network. It is preferable that such a network comprise prioritisation of digital transmissions to ensure data throughput for both important imaging and data communications operations.

Setting up each camera for image analysis is preferably performed by security staff once the camera is installed. The staff sets the camera to transmit images to the central monitoring station and, through configuration or preference settings determines an algorithm for weighting images and portions of each image for analysis. These parameters are then transmitted to the camera. When desirable, the images and values determined by analysis are reviewed to ensure proper functioning of a camera. Alternatively, the configuration and/or preferences are established using a training algorithm such as a genetic algorithm, a neural network, or an annealing algorithm provided with images that are weighted by security staff as a training data set.

When bandwidth considerations are significant or unknown, video image compression is implemented within each camera and decompression is implemented in the central monitoring system. Video compression routines such as MPEG are extremely well suited to applications of this type, as are other known video compression systems that result in minimal loss of image quality. Preferably, when image quality is lost through compression, each frame is indexed and an individual at the central monitoring system is capable of requesting and receiving a frame from a recording without loss in dependence upon indexing information. One method of accomplishing this is using a plurality of video recorders with a single video camera wherein one records at any given time allowing the other recorder to retrieve images. In such a system, frame indexing for accurate reconstruction is essential. Alternatively, two tapes can record simultaneously. One of the tapes providing a master while the other allows for retrieving past frames.

The use of a digital network 50 as described herein provides numerous advantages. Network topology changes for digital networks are generally easily implemented without requiring extensive installation of cable. Digital networks are designed to be modified and

to allow for relocation of computers connected thereto; therefore, they are well suited to allowing surveillance cameras to move as necessary. Digital networks also have an advantage of being installed in many buildings for computers therein. The presence of such an infrastructure, reduces the overall cost of implementing a video surveillance system according to the invention. The use of a digital network 50 allows the central monitoring station to be relocated without significant difficulty.

The use of a digital network 50 according to the invention for conveying the surveillance information, also allows security personnel to view surveillance information from remote locations or from locations within the building that are not designated security monitoring stations. For example, when a fire alarm is reported, a security person monitors the surveillance systems about the fire. It is often preferable that the monitoring be performed in close proximity to the fire in order to aid rescue personnel. As such, a workstation proximate the fire is used for surveillance and the emergency personnel are capable of monitoring the situation visually upon arrival. One method of accomplishing this is to send a new network address for the monitoring system to the imaging input device. Another method is to retransmit received digital representations from the monitoring system to a computer proximate the fire.

The central monitoring station 200v is a computer functioning as a server and coupled with at least a monitor 300. Preferably the central monitoring station 200v is provided with a recording system for recording images provided through the digital network 50 thereto. Alternatively, some video cameras 100 are provided with recording means. Recording means are well known in the art and include magnetic recording means as found in conventional video cameras and digital recording means - a computer coupled with each camera for receiving a digital signal therefrom and for recording the digital signal in non-volatile memory. When a computer is used as a recording means, the computer preferably transmits the recorded data to a network data server for backup at some later time.

The central monitoring system 200v comprises software for controlling the video cameras 100. This software comprises test software for verifying a presence and operation

of cameras; set-up software for initialising cameras and for loading preferences, algorithms, and other data into cameras; and operating software for polling cameras, receiving image data from video cameras, and for recording camera data for future review.

For example, a central monitoring station in the form of a video server 200v is provided with a plurality of monitors. On some of the monitors, images provided via the digital network 50 to the video server 200v are displayed. Another monitor displays surveillance related information in the form of current camera status, camera locations, etc. Optionally, the system also displays information relating to security in the form of fire alarm status, door status, and so forth.

In a preferred embodiment, the displayed information is automatically displayed in accordance with a default display mode. The default display mode is capable of being overridden by security staff in order to view particular images, locations, or status information. This provides a hands-off monitoring system with the flexibility required for surveillance operations.

Referring to Fig. 10a a simplified block diagram of a video surveillance camera according to the invention is shown. The digital video camera 100b comprises imaging means in the form of a lens and a charge coupled device (CCD), an analogue to digital converter, RAM, a processor, and a digital communication means in the form of a digital network interface circuit. Optionally, the analogue to digital converter is integrated into the CCD. The processor means is for performing at least one of two functions - compression and analysis. Compression is used to reduce image data to reduce consumption of digital network bandwidth. Analysis is used to evaluate captured images in order to conserve network bandwidth when digital representations of images have little information over previously transmitted information.

Preferably, the device of Fig. 10a is contained within a single housing and forms an integrated video camera for interfacing with a digital network.

Referring to Fig. 10b, another embodiment of the surveillance video camera is shown wherein the image capture means in the form of a lens and a CCD are contained within one housing and the remaining electronics is contained within another housing. This permits the image capture means to remain small for easily being concealed from view. The remainder of the electronics forms a processing unit and is located a distance away, for example within a wall or a utility closet. When the processor means is sufficiently powerful, a plurality of imaging means is optionally connected to a single processing unit. This is useful for monitoring small areas with several image capture means simultaneously.

According to another aspect of the invention, a digital network has installed thereon video cameras and biometric sensors. The biometric sensors are used for authorising system access across the network. Some example applications are discussed below.

Referring to Fig. 11, a digital network 50 in the form of an Ethernet network is installed within a building. Digital networks, as described above, are well known. For example, an Ethernet network provides an easily upgraded and modified network. To the digital network 50 are connected workstations 54 and servers 56. The workstations 54 are computer systems for use by users. The servers 56 are for providing central file storage, network applications, and more powerful processors for executing processor intensive tasks. Some common network applications include email, intranet, accounting, parts lists, employee phone list, etc. Biometric sensors 210a and 210b are coupled directly to the digital communication network 50 at a plurality of locations. Optionally, biometric sensors 210a are coupled to workstations 54a coupled to the digital communications network 50.

Network security is enhanced through biometric identification of users. The biometric identification of individual users permits a plurality of easily enforced user access levels, accurate billing of network use, and integration of electronic equipment for accounting and security. Referring to Fig. 11, a plurality of common network peripherals such as workstations 54, servers 56, and printers 58 are shown. Unconventional network

peripherals such as video source devices 100, door locks 62, biometric sensors 210a and 210b, and video server 200v are shown. Optionally, peripherals such as vending machines, photocopiers, telephones, facsimile machines, supply cabinets, manufacturing equipment, and inventory storage bins are also in communication with the digital network 50.

Through appropriate hardware and co-operating software, each peripheral receives information in dependence upon a user identification. This information is used to provide security functions or to provide activity logs and billing related information.

Network access is provided through biometric information authentication. Referring to Fig. 12, a user desiring to use a network function requires authorisation. User authorisation is performed by identifying a user in dependence upon biometric information provided by the user. A user desiring to use a peripheral connected to the digital network 50 provides a user identification in the form of a PIN, a name, or a log in ID. The user then identifies the peripheral device to be used. Some examples of peripheral devices according to the invention include video cameras, printers, phones, doors, computer systems, and environmental controls. The user then provides biometric information at a biometric input device 210a or 210b (See Fig. 11). Preferably, each of the data inputs from the user are provided at a same input terminal. When user identification is complete and the user has access privileges to the peripheral device, access is provided; optionally, the activity - either access or denied access - is logged.

Referring to Fig. 13, a specific embodiment of the method described with reference to Fig. 12 is shown wherein the peripheral device is a door lock mechanism. A user provides user identification, a doorway identifier and biometric information to a biometric input device 210b. Once user identification is complete and the biometric information is identified as that of the user, and provided that the user is permitted access through the identified doorway, the door lock is actuated and the user is permitted to pass therethrough; optionally, the event is recorded in an activity log.

Referring to Fig. 14, a method of accessing a peripheral system is shown. A user provides biometric information at a biometric sensor 210b coupled to the digital network 50. The user is identified in dependence upon the biometric information provided. Access privileges for the user are determined. The user then accesses a peripheral proximate the biometric sensor. Some methods of accessing a peripheral system include turning a door knob, pressing a function button on a printer or photocopier, executing a software program, and lifting a telephone handset. For example, when a security person wants to view images from a predetermined video camera, the security person provides biometric information to a biometric sensor 210b proximate a computer workstation 54. The security person then actuates a software program for viewing video images from the predetermined video camera on the workstation 54. When the security person is identified and has access privileges to the software program, the program executes; optionally, a record of the event is stored in an activity log. Similarly, an executive is permitted to make long distance calls from any telephone connected to the digital network 50 and the telephone call is logged according to the executive's preferences and billed to his budget.

When a user attempts to access or to "log on" to a server 56a, the user provides biometric information to a biometric sensor 210b for authentication. Once identified, the user is either permitted access to the server 56a or denied said access. When a biometric sensor 210a is coupled to a workstation 54a, this is straightforward as existing log on procedures modified to accept biometric information are used. When the biometric sensor 210b is coupled directly to the digital network 50, some indication must be provided that a specific biometric sensor is being used by a particular user. For example, a biometric sensor 210b is associated with a workstation 204b. Alternatively, a biometric sensor is provided with a keypad for entering further information. A workstation asks for a user ID and biometric information number 2123. The user then provides biometric information to the biometric sensor 210b and keys 2123 into a keypad associated therewith. The information is provided to a central security server for user authentication and system access.

Referring to Fig. 15, the network 50 is also provided with a printer 58. The printer is provided with a memory buffer for storing printer output. When a secure document is transmitted to the printer, it is stored in the memory buffer and not printed. A user desiring to collect secure printouts provides biometric information to a biometric sensor 210b adjacent the printer and thereby initiates printing of confidential material. As such, confidential printouts are protected even on the network. Alternatively, the biometric input device is integrated into the printer and the user provides biometric information to the printer 58 directly or to the digital network 50 via the printer 58. When the biometric sensor is integrated into the printer and dedicated to printer security, identifying a peripheral when providing the biometric information is unnecessary. When a biometric input device integrated within the printer 58 is merely another biometric input device 210 coupled to the digital network and not dedicated to printer security, identification of a peripheral is required.

Referring to Fig. 16, a simplified flow diagram of a method of enhancing security of print outs without requiring special printer hardware is shown.. A print server is provided with a memory buffer for storing printer output. When a secure document is transmitted to the server for printing, it is stored in the memory buffer and not printed. A user desiring to collect secure printouts provides biometric information to a biometric sensor 210b adjacent the printer, the server maintaining secure printouts receives the user identification and a printer to which to transmit the print job. The print job is transmitted to that printer thereby initiating printing of confidential material. As such, confidential printouts are protected even on the network 50.

Referring to Fig. 17, a system for building surveillance and security is shown. A video server in the form of a computer network server 206v is coupled to a digital network 50. A plurality of video cameras 100 are coupled to the network 50. Each video camera 100 provides a video image frame to the video server 206v when a significant change occurs over a previous image frame. Preferably, significant changes are defined in dependence upon a desired level security. For example, in a low traffic area where a high level of security is desired, any change is significant. Alternatively, in high traffic areas,

only a portion of an image frame is significant - for example, a desk drawer or removal of particular equipment. As such, when a change in an image frame over a previous image frame is significant, the image frame is provided via the digital network 50 to the server 206v. This is accomplished in accordance with a method as set out above.

The image frames are displayed on a monitor forming part of the video server 206v. Security personnel can select a video source 100 to monitor or can simply view image frames that change as change occurs. When a significant change is detected, a security person is dispatched to inspect. On the way, the security person accesses several secure areas 220, 221, 222, and 223 (shown in Fig. 18). In order to access each area, biometric information is provided to a biometric input sensor 210b. At each doorway, a workstation 54 is disposed. The security person identifies the video camera 100 and provides biometric information and is provided with images from the video camera 100 on the workstation 54 prior to passing through each secure doorway. Only predetermined individuals can access the video information on the network 50.

Referring to Fig. 19, a biometric imaging input device for use with the invention is shown. The device is provided with a numeric key pad 191 for entering user identification codes in the form of PIN numbers. A speaker 192 provides auditory feedback in the form of access permitted or denied. Optionally, the speaker allows security personnel to speak to users attempting access. When the bi-directional communication is desirable, a microphone is included within the biometric information input device. A biometric input means 193 in the form of a platen upon which a finger tip is rested to allow for imaging of a fingerprint is disposed on the face of the unit. A digital communication interface in the form of an Ethernet connector and associated circuitry (not shown) is provided to permit installation of the sensor device on a digital network.

Of course, telephones disposed on a digital communication network 50 are controlled in a similar fashion. When someone's pager indicates an incoming call, they provide biometric information to a biometric input sensor 210b and the call is provided to a closest telephone. Alternatively, they provide biometric information and an extension

number and a telephone having that extension number is provided with the call. Referring to Fig. 21, when a telephone is provided with an integrated biometric information sensor 193, the person lifts the handset while providing biometric information to the integrated biometric sensor 193 in order to provide same functionality.

Many applications for the method according to the invention are envisioned. Device access and activity logs provide significant advantages for automatic teller machines, hospital medication and equipment access, corporate cost assessments and allocation of expenses, employee time monitoring - punching in and punching out, safety deposit boxes, etc. The use of biometric sensors to identify an individual and to restrict access is well known; however, the combination of security in dependence upon biometric input information and monitoring or logging of non computer system access provides significant advantages as described above.

Alternatively, when a biometric input device is integrated into a peripheral device, the peripheral device is a default peripheral that is identified according to the method of the invention in the absence provision of another peripheral identification.

Alternatively, a video camera is replaced with a digital camera for capturing individual images. When such is the case, image acquisition is initiated by a signal from the central monitoring system.

Numerous other embodiments may be envisaged without departing from the spirit and scope of the invention.

Claims

What is claimed is:

1. An imaging input system for use with a digital communication network supporting a digital communication protocol, the digital network for simultaneous connection to a plurality of computers, the system comprising
an imaging input device, the device comprising:

means for capturing images and for providing digital representations of the images;

means for receiving the digital representations of the images and for processing some of the digital representations to provide data in dependence thereon; and having a single digital data output port comprising a dedicated means unassisted by a personal computer, for providing some of the data to the digital communications network using the digital communication protocol.

2. An imaging input system for use with a digital communication network as defined in claim 1 wherein digital communication protocol is Ethernet.

3. An imaging input system for use with a digital communication network as defined in claim 1 wherein the input device comprises means for identifying the imaging input device to other devices in communication with the digital communication network.

4. An imaging input system for use with a digital communication network as defined in claim 1 wherein the imaging input device comprises means for receiving data from the digital communication network and means responsive to received data for configuring the surveillance camera.

5. An imaging input system for use with a digital communication network as defined in claim 1 wherein the imaging input device comprises means for receiving data from the

digital communication network and means responsive to received data for determining data to provide to the digital communication network.

6. An imaging input system for use with a digital communication network as defined in claim 1 wherein the only digital data interface to the imaging device is the digital communication network.

7. An imaging input system for use with a digital communication network as defined in claim 1 wherein the only image data output from the imaging device is the digital communication network.

8. An imaging input system for use with a digital communication network as defined in claim 1 wherein the imaging device is a surveillance camera.

9. An imaging input system for use with a digital communication network as defined in claim 1 wherein the imaging device is a biometric imaging device.

10. An imaging input system for use with a digital communication network as defined in claim 1, the system comprising:

a monitoring system for coupling with the digital communication network at a location different from that of the means for imaging, the monitoring system comprising:

> means for receiving data provided by the means for providing some of the data to the digital communications network, and
>
> means for displaying or recording the data.

11. An imaging input system for use with a digital communication network as defined in claim 5 comprising:

a monitoring system for coupling to the digital communication network at a location different from that of the imaging input device, the monitoring system comprising:

means for receiving data provided by the means for providing some of the data to the digital communications network,

means for communicating with the means for receiving data from the digital communication network of the imaging input device to request a transmission of data; and

means for displaying or recording the data.

12. An imaging input system for use with a digital communication network as defined in claim 1 wherein the imaging input device comprises a single housing and wherein the entire imaging input device is housed within said single housing.

13. An imaging input system for use with a digital communication network as defined in claim 12 wherein the only digital data interface to the surveillance camera is the digital communication network.

14. An imaging input system for use with a digital communication network supporting a digital communication protocol, the digital network for simultaneous connection to a plurality of computers, the system comprising:

an image input device comprising:

means for capturing images and for providing digital representations of the images;

means for receiving the digital representations of the images and for processing some of the digital representations of the captured images to provide data in dependence thereon consisting of at least a processor, non-volatile memory, volatile memory, and means for providing some of the data to the digital communications network using the digital communication protocol.

15. An imaging input system for use with a digital communication network supporting a digital communication protocol, the digital network for simultaneous connection to a plurality of computers, the system comprising:

an image input device comprising:

a housing;

means, disposed within the housing, for capturing images and for providing digital representations of the images;

means, disposed within the housing, for receiving the digital representations of the images and for processing some of the digital representations to provide data in dependence thereon; and

means, disposed within the housing, for providing a compressed digital video output signal of some of the data to the digital communications network using the digital communication protocol.

16. A method of capturing images for use with a digital communication network, the method comprising the steps of:

capturing images using image capture means disposed in different locations;

providing digital representations of the captured images to a processor;

processing the digital representations of the images using the processor;

transmitting the processed digital representations of the images to a monitoring system using a digital communication protocol supported by the digital communication network coupled between the image capture means and the monitoring system;

receiving the digital representations of the images at the monitoring system and alternately displaying images from different video cameras on a monitor coupled to the video server.

17. A method of capturing images for use with a digital communication network as defined in claim 16 comprising the steps of:

analysing the digital representations to provide a score associated with a digital representation; and

transmitting the scores for digital representations to a monitoring system using a digital communication protocol supported by the digital communication network coupled between the image capture means and the monitoring system, and, wherein the step of

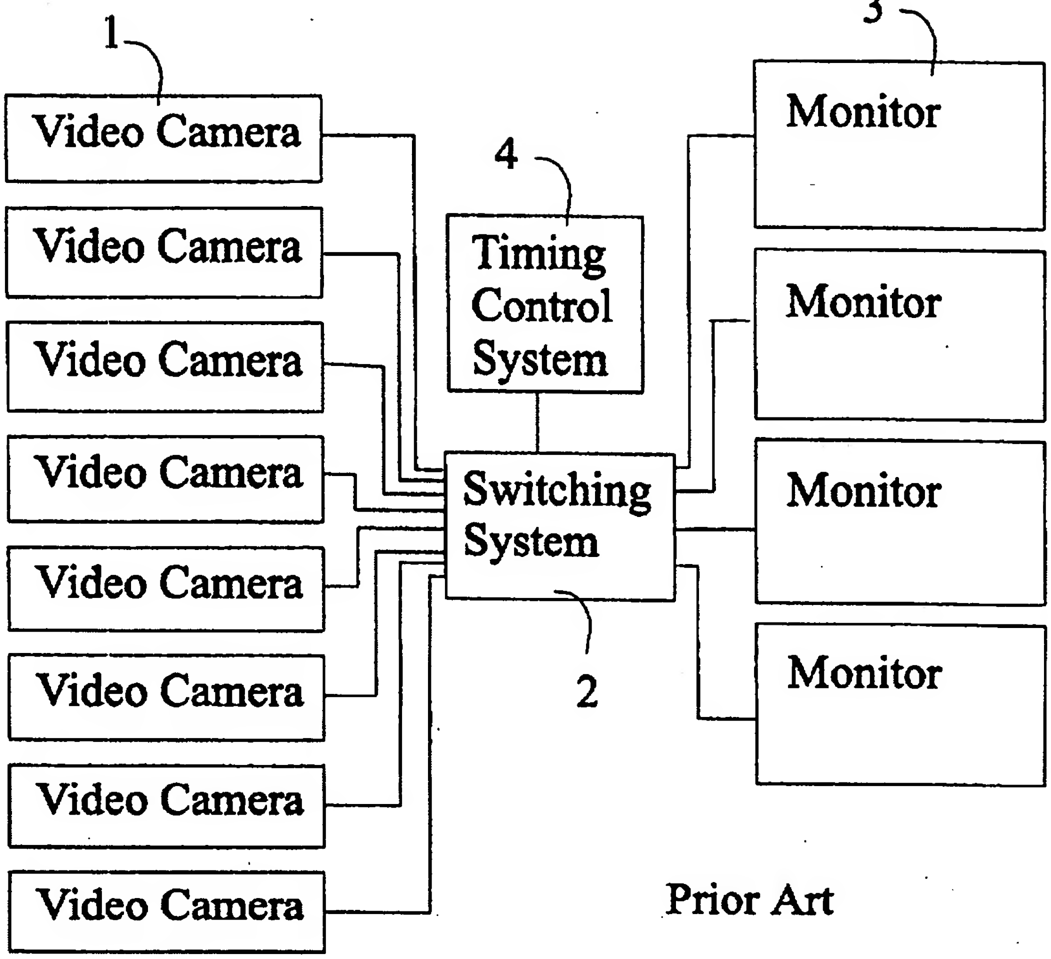
transmitting the processed digital representations of the images to a monitoring system using a digital communication protocol supported by the digital communication network coupled between the image capture means and the monitoring system is performed in dependence upon a signal transmitted from the monitoring system using the digital communication protocol supported by the digital communication network.

18. A method of capturing images for use with a digital communication network as defined in claim 16 wherein the step of transmitting the processed digital representations of the images to a monitoring system using a digital communication protocol supported by the digital communication network coupled between the image capture means and the monitoring system is performed in dependence upon differences between the digital representation and a previous digital representation.

19. A method of capturing images for use with a digital communication network as defined in claim 16 wherein the step of transmitting the processed digital representations of the images to a monitoring system using a digital communication protocol supported by the digital communication network coupled between the image capture means and the monitoring system is performed in dependence upon differences between predetermined portions of the digital representation and same predetermined portions of a previous digital representation.

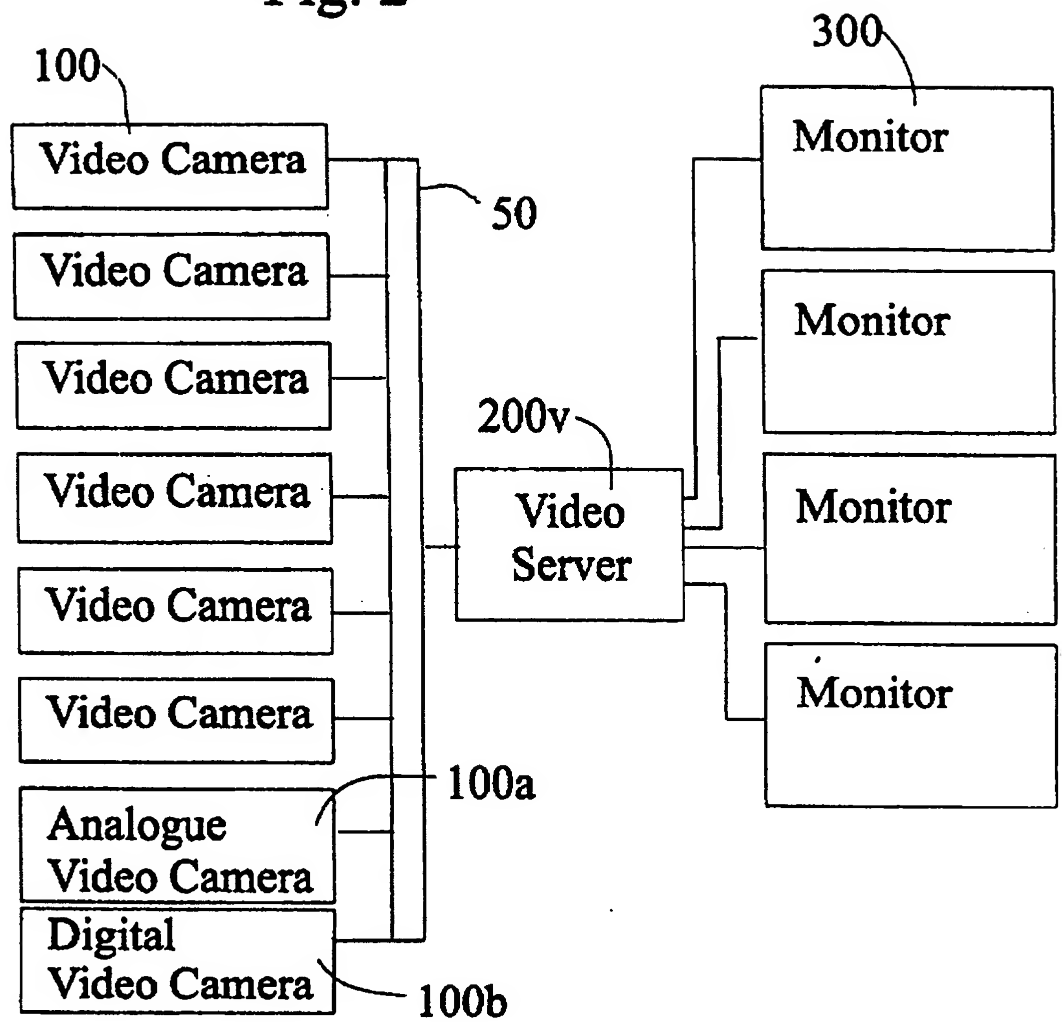
20. A method of capturing images for use with a digital communication network as defined in claim 16 comprising the step of providing biometric information to a biometric information sensor, and wherein at least one of the steps of transmitting the processed digital representations of the images to a monitoring system and displaying images on a monitor coupled to the video server is performed in dependence upon the biometric information provided.

Fig. 1



Prior Art

Fig. 2


100
Video Camera
Video Camera
Video Camera
Video Camera
Video Camera
Video Camera
Analogue Video Camera
Digital Video Camera
50
100a
100b
200v
Video Server
300
Monitor
Monitor
Monitor
Monitor

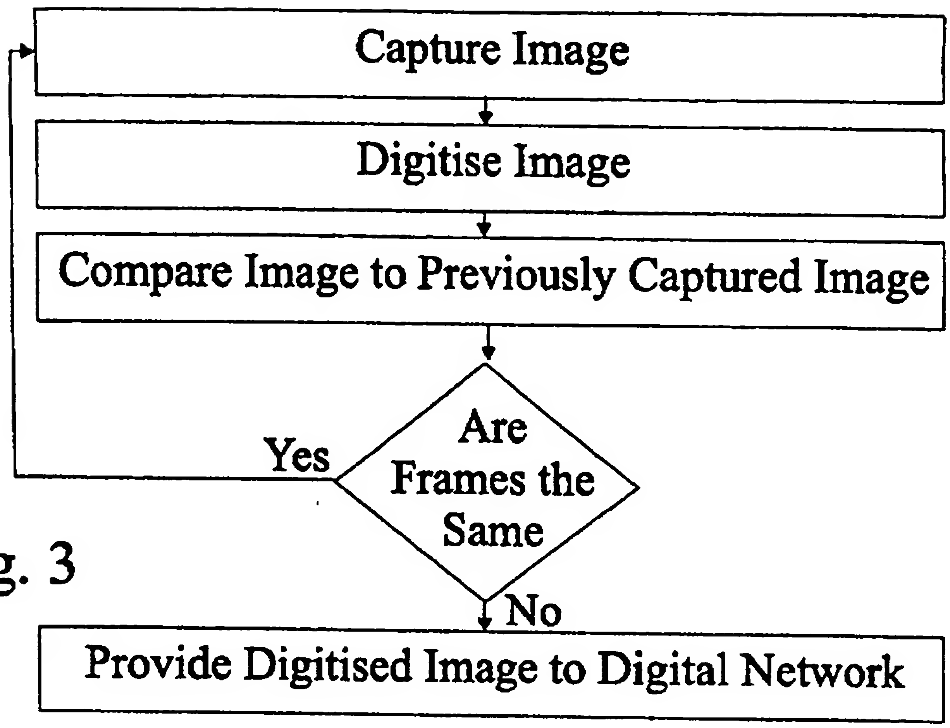

Capture Image
Digitise Image
Compare Image to Previously Captured Image
Are Frames the Same
Yes
No
Provide Digitised Image to Digital Network

Fig. 3

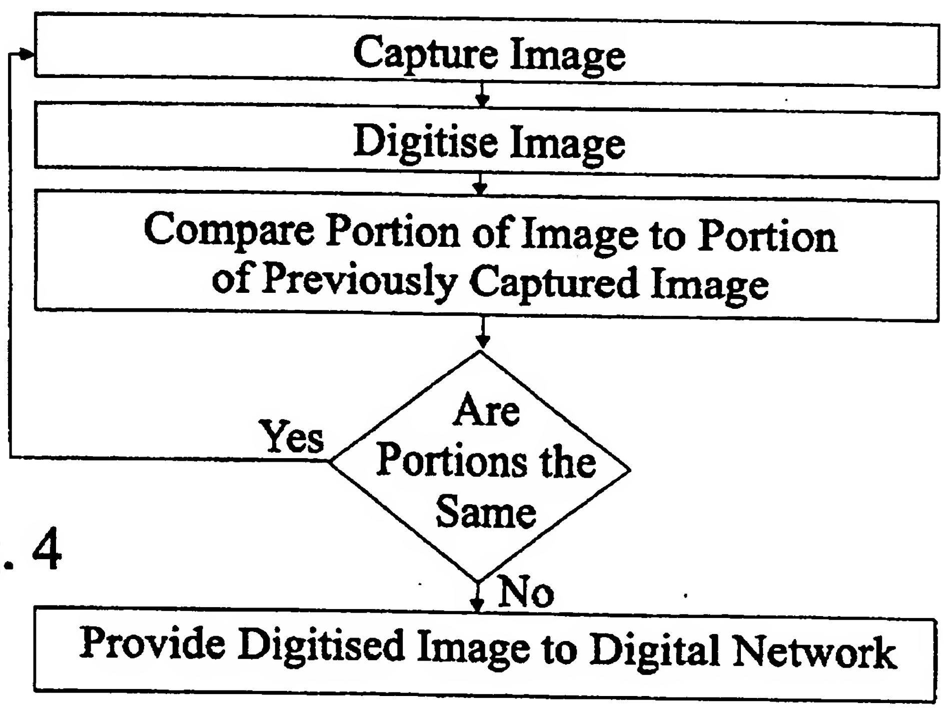

Capture Image
Digitise Image
Compare Portion of Image to Portion of Previously Captured Image
Are Portions the Same
Yes
No
Provide Digitised Image to Digital Network

Fig. 4

Fig. 5

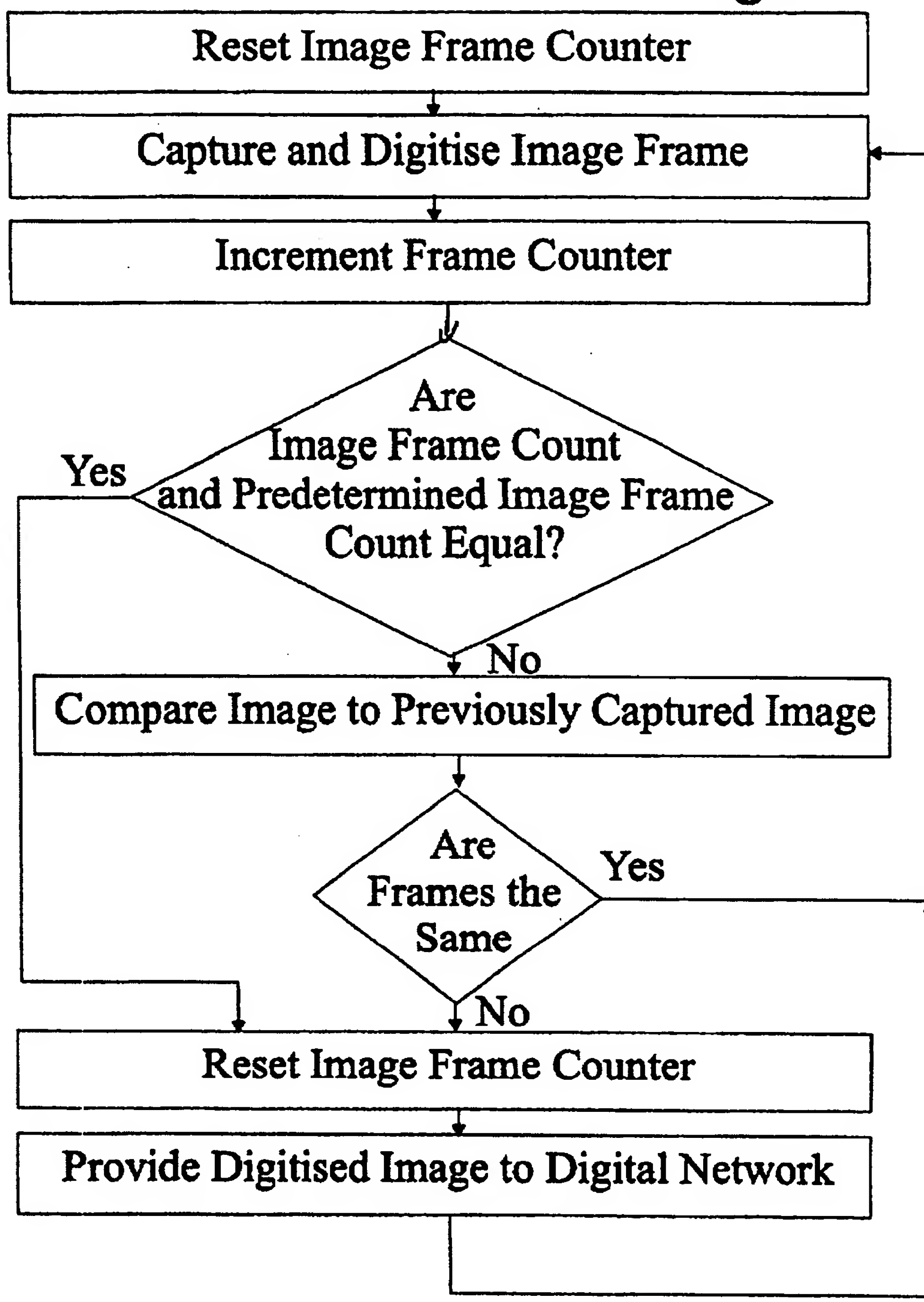
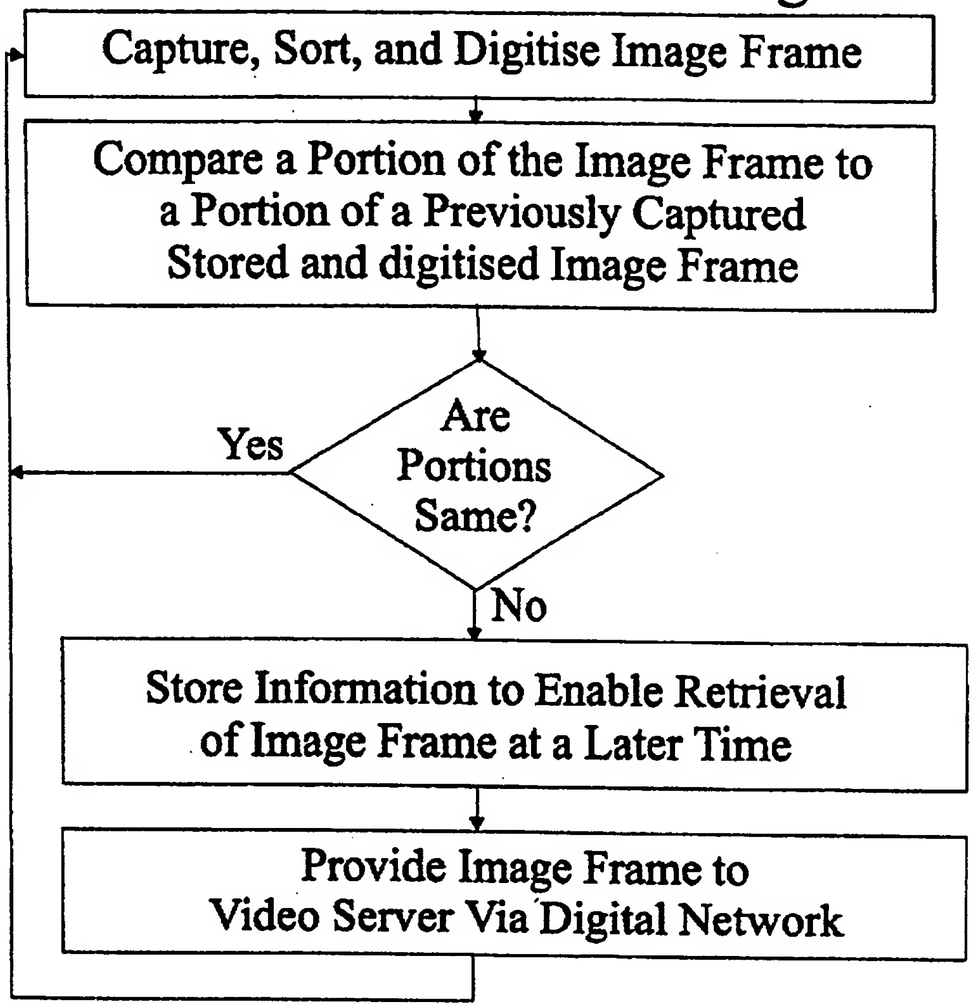
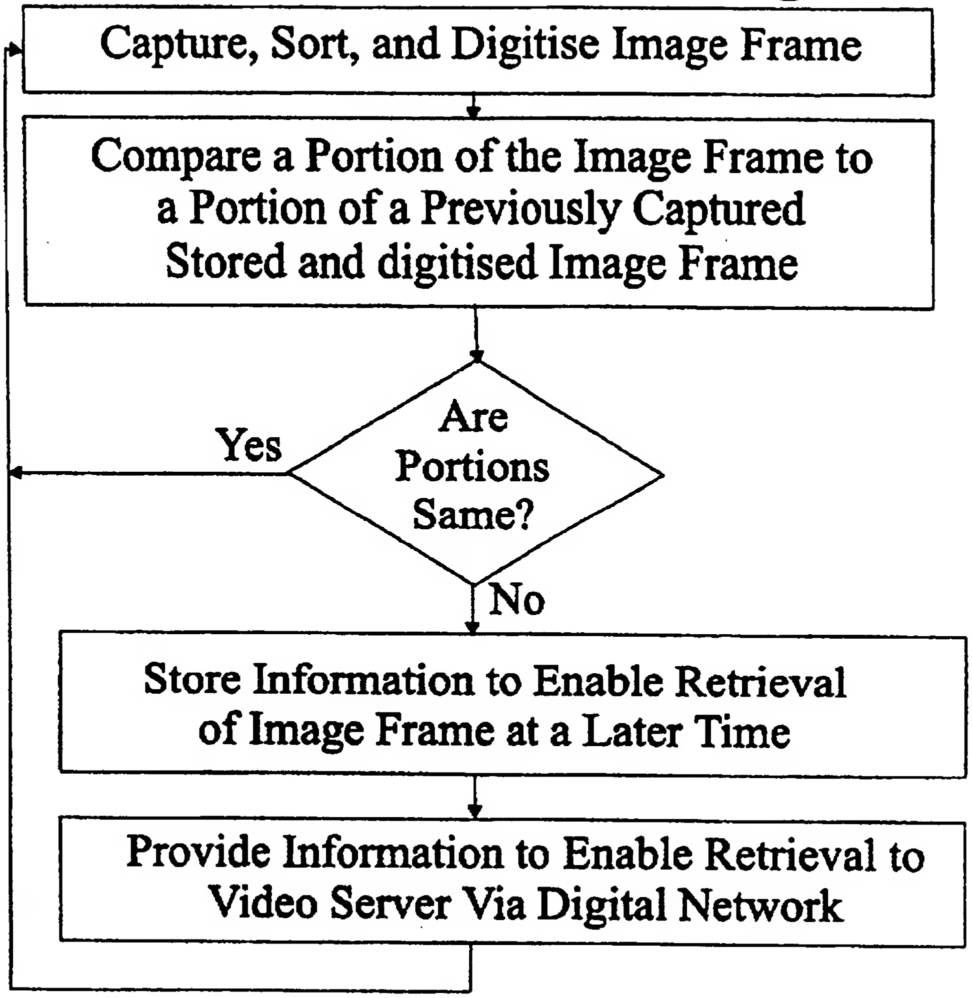

Reset Image Frame Counter
Capture and Digitise Image Frame
Increment Frame Counter
Are Image Frame Count and Predetermined Image Frame Count Equal?
Yes
No
Compare Image to Previously Captured Image
Are Frames the Same
Yes
No
Reset Image Frame Counter
Provide Digitised Image to Digital Network

Fig. 6a



Capture, Sort, and Digitise Image Frame
Compare a Portion of the Image Frame to a Portion of a Previously Captured Stored and digitised Image Frame
Are Portions Same?
Yes
No
Store Information to Enable Retrieval of Image Frame at a Later Time
Provide Image Frame to Video Server Via Digital Network

Fig. 6b



Capture, Sort, and Digitise Image Frame
Compare a Portion of the Image Frame to a Portion of a Previously Captured Stored and digitised Image Frame
Are Portions Same?
Yes
No
Store Information to Enable Retrieval of Image Frame at a Later Time
Provide Information to Enable Retrieval to Video Server Via Digital Network

Fig. 7

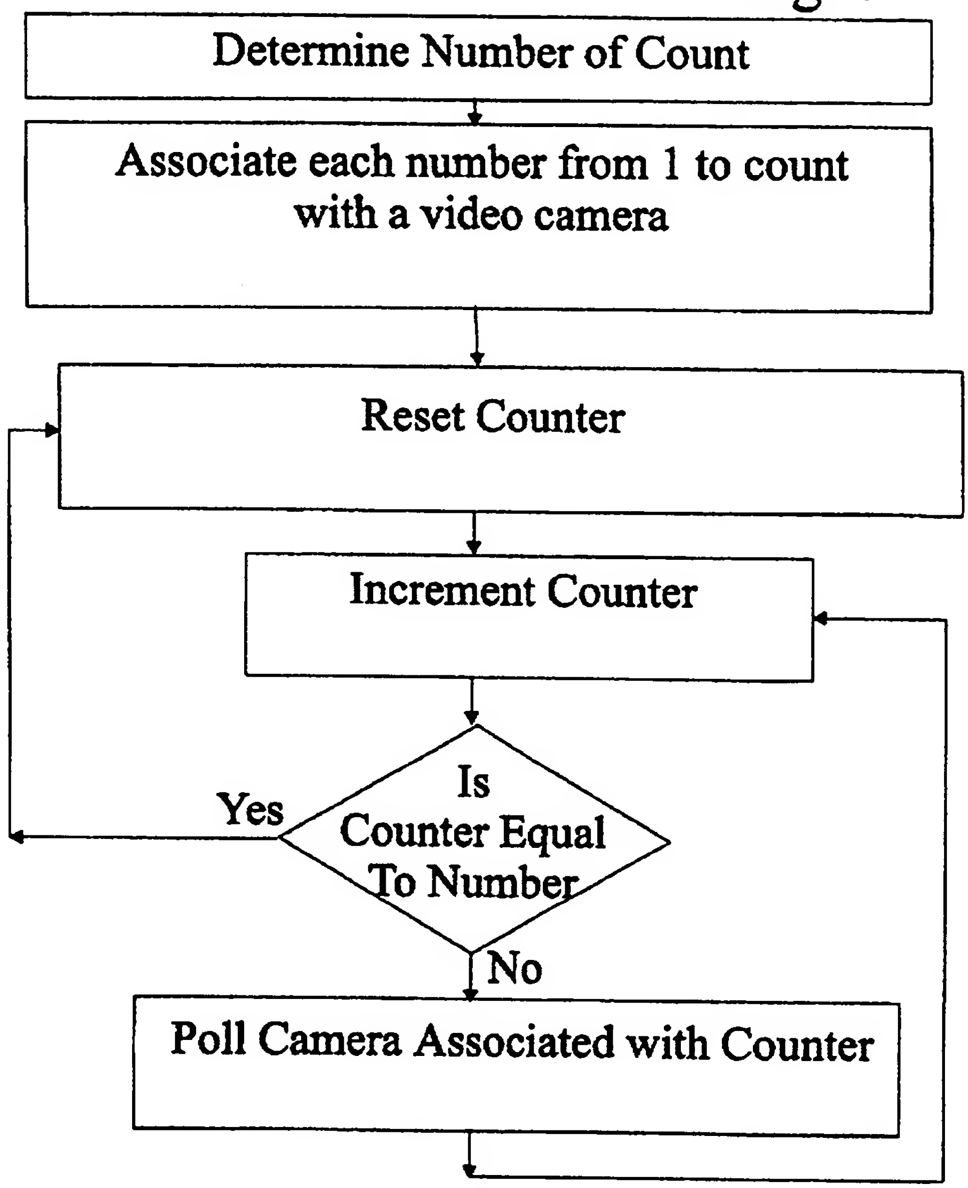
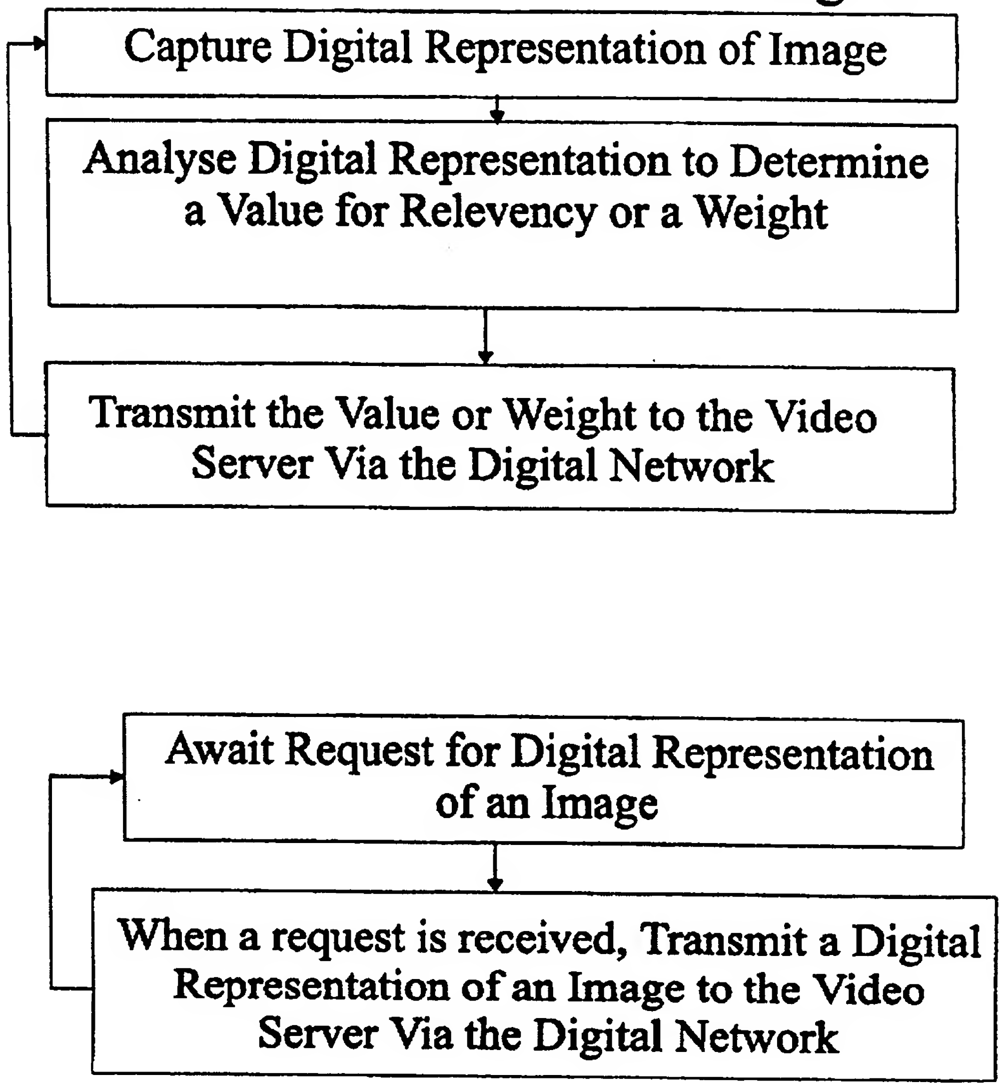

Determine Number of Count
Associate each number from 1 to count with a video camera
Reset Counter
Increment Counter
Is Counter Equal To Number
Yes
No
Poll Camera Associated with Counter

Fig. 8



Capture Digital Representation of Image
Analyse Digital Representation to Determine a Value for Relevency or a Weight
Transmit the Value or Weight to the Video Server Via the Digital Network
Await Request for Digital Representation of an Image
When a request is received, Transmit a Digital Representation of an Image to the Video Server Via the Digital Network

Fig. 9

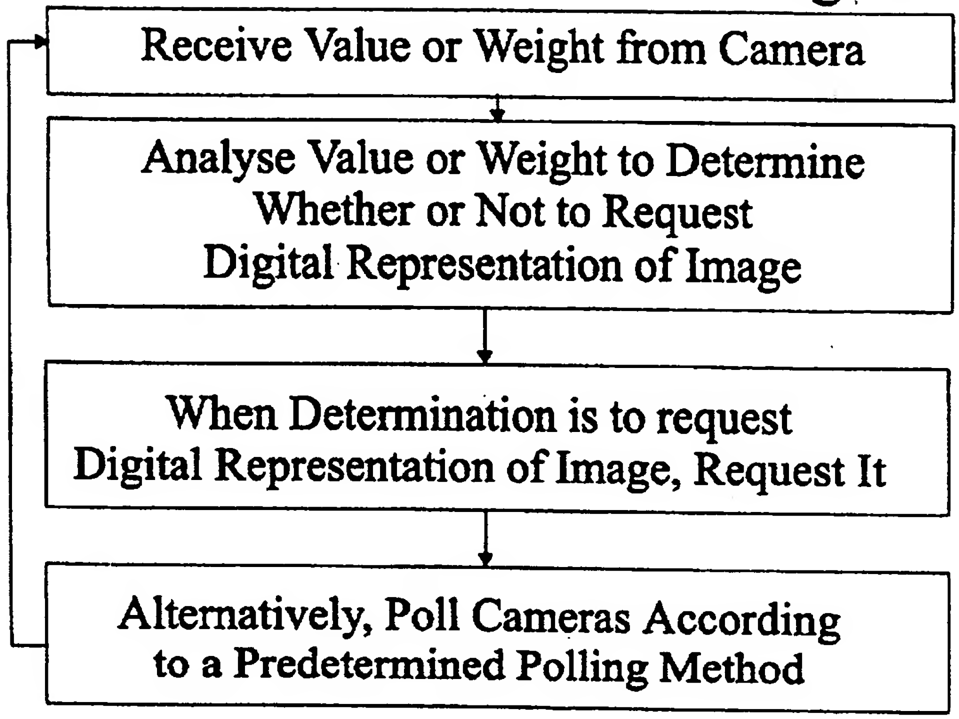

Receive Value or Weight from Camera
Analyse Value or Weight to Determine Whether or Not to Request Digital Representation of Image
When Determination is to request Digital Representation of Image, Request It
Alternatively, Poll Cameras According to a Predetermined Polling Method

Fig. 10a

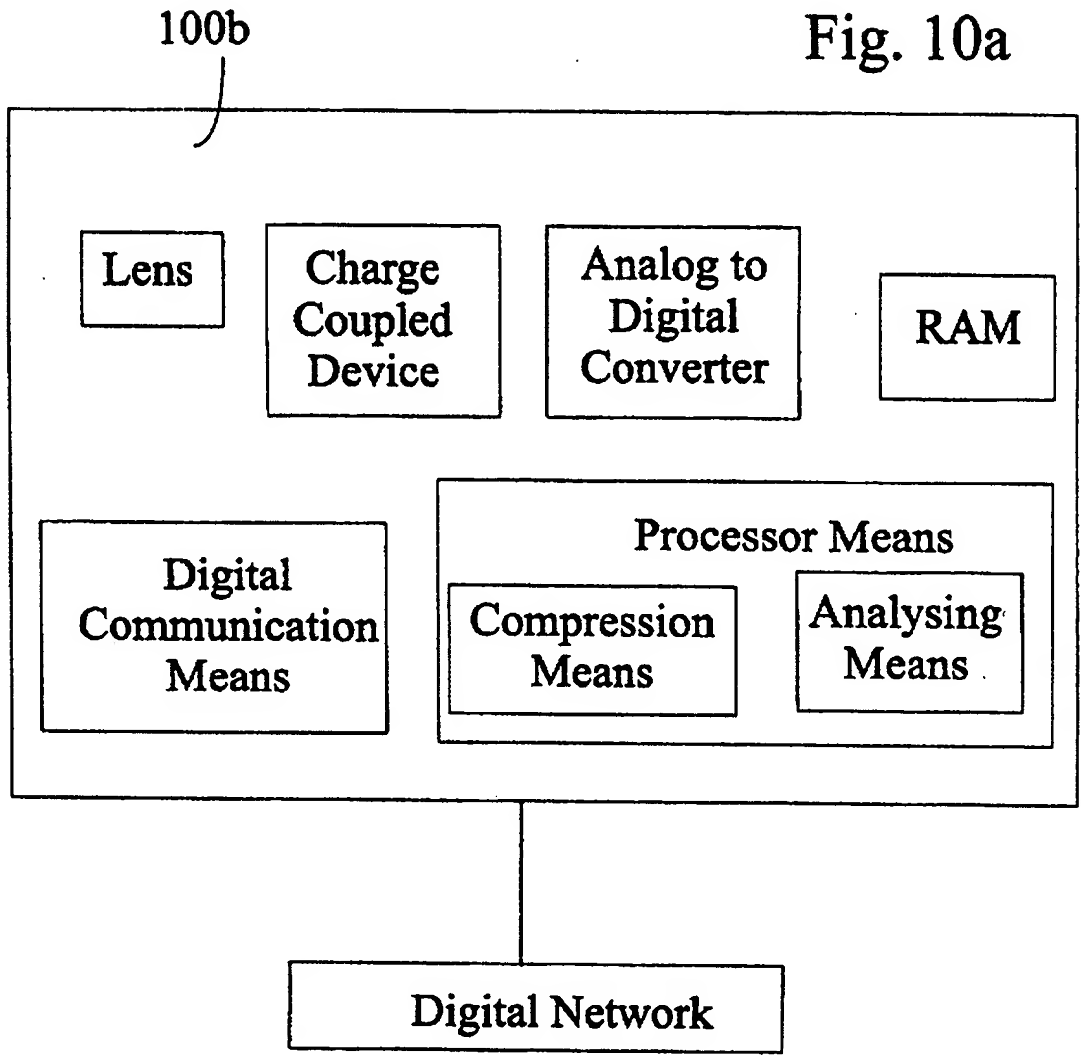
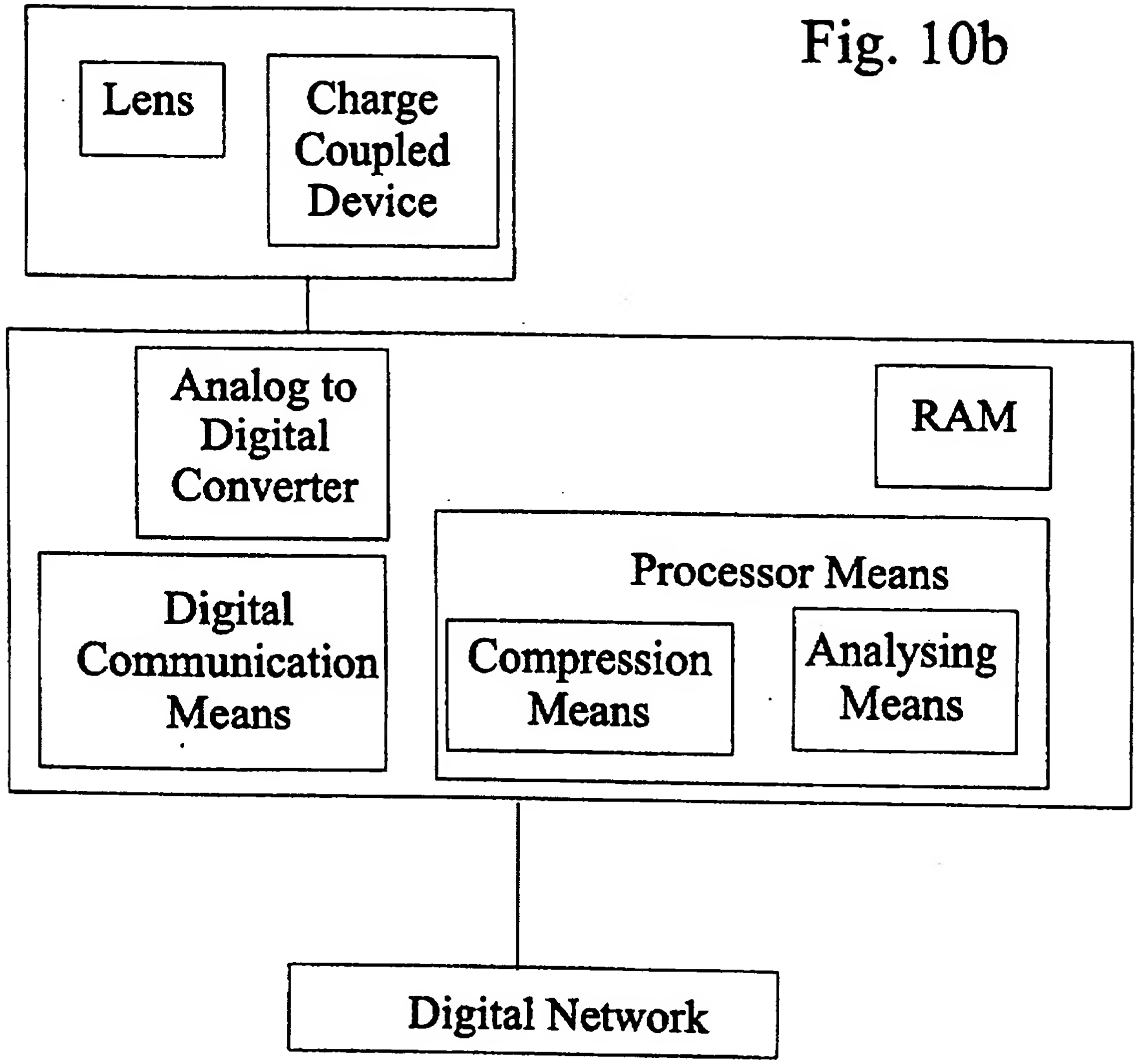

100b
Lens
Charge Coupled Device
Analog to Digital Converter
RAM
Digital Communication Means
Processor Means
Compression Means
Analysing Means
Digital Network

Fig. 10b


Lens
Charge Coupled Device
Analog to Digital Converter
RAM
Processor Means
Digital Communication Means
Compression Means
Analysing Means
Digital Network

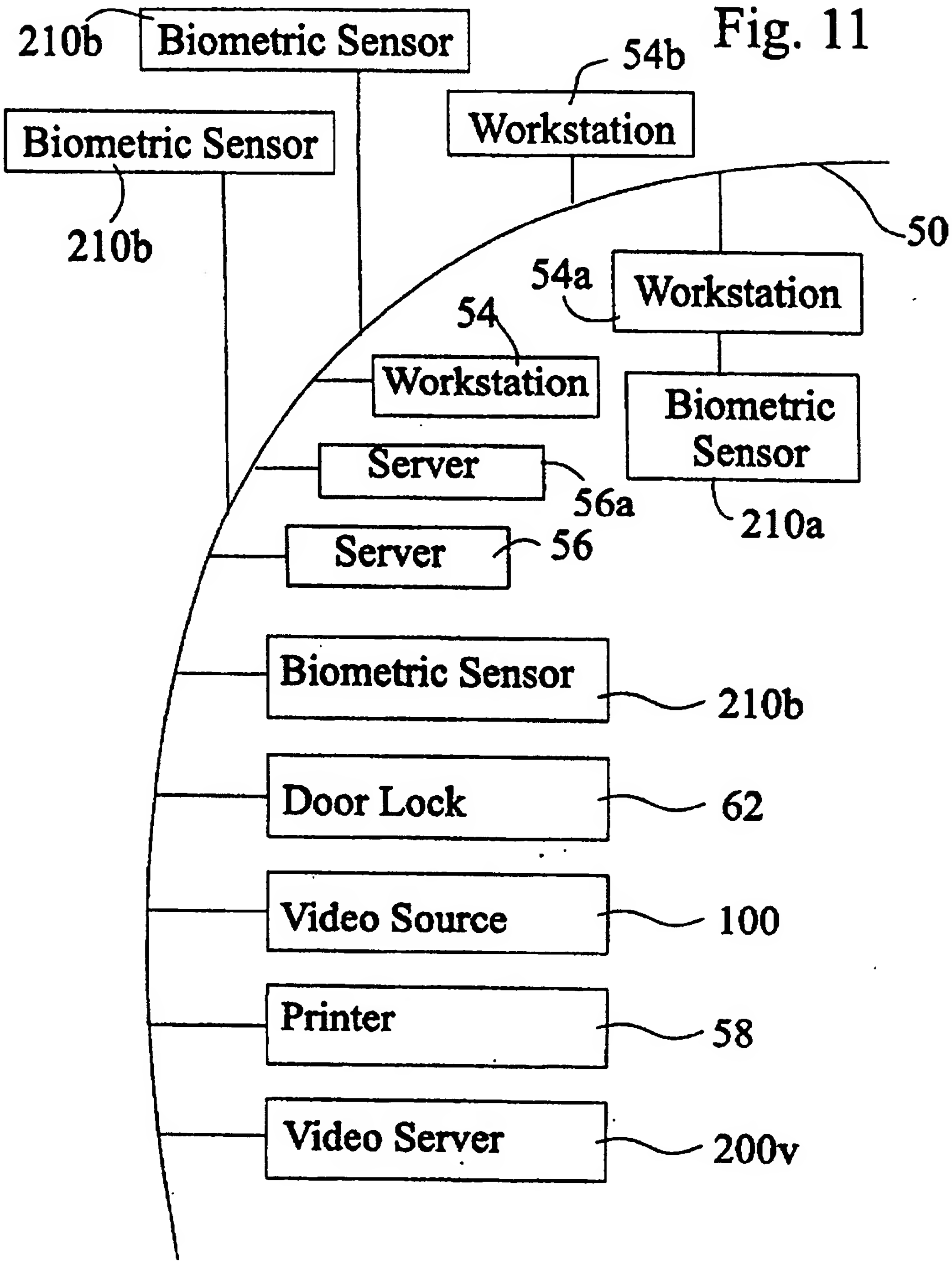

210b
Biometric Sensor
54b
Workstation
Biometric Sensor
210b
50
54a
Workstation
54
Workstation
Biometric
Sensor
Server
56a
210a
Server
56
Biometric Sensor
210b
Door Lock
62
Video Source
100
Printer
58
Video Server
200v

Fig. 11

Fig. 12

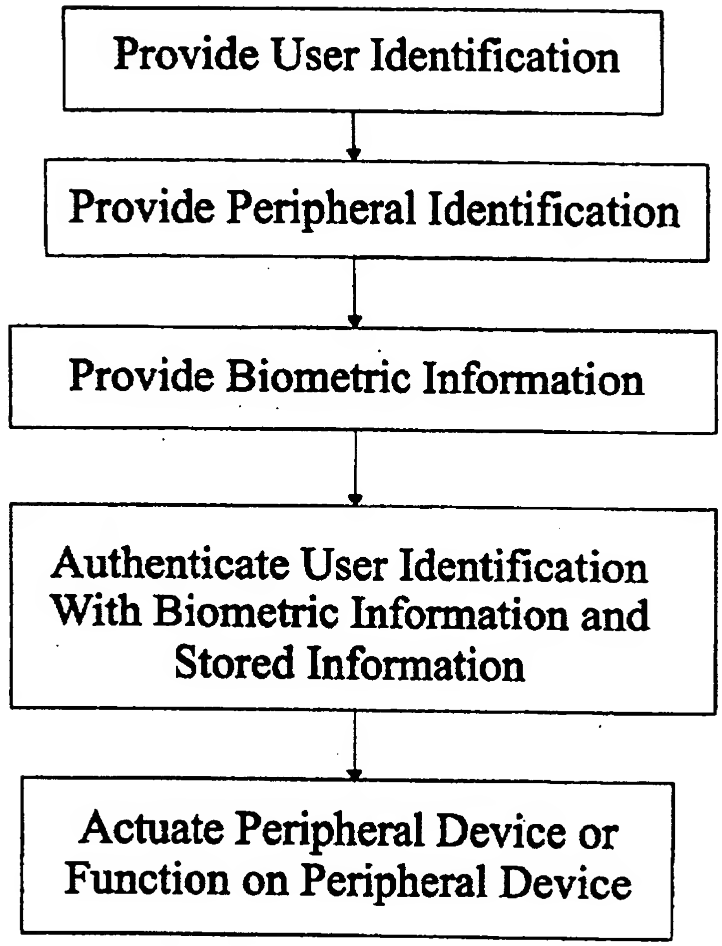

Provide User Identification
Provide Peripheral Identification
Provide Biometric Information
Authenticate User Identification With Biometric Information and Stored Information
Actuate Peripheral Device or Function on Peripheral Device

Fig. 13

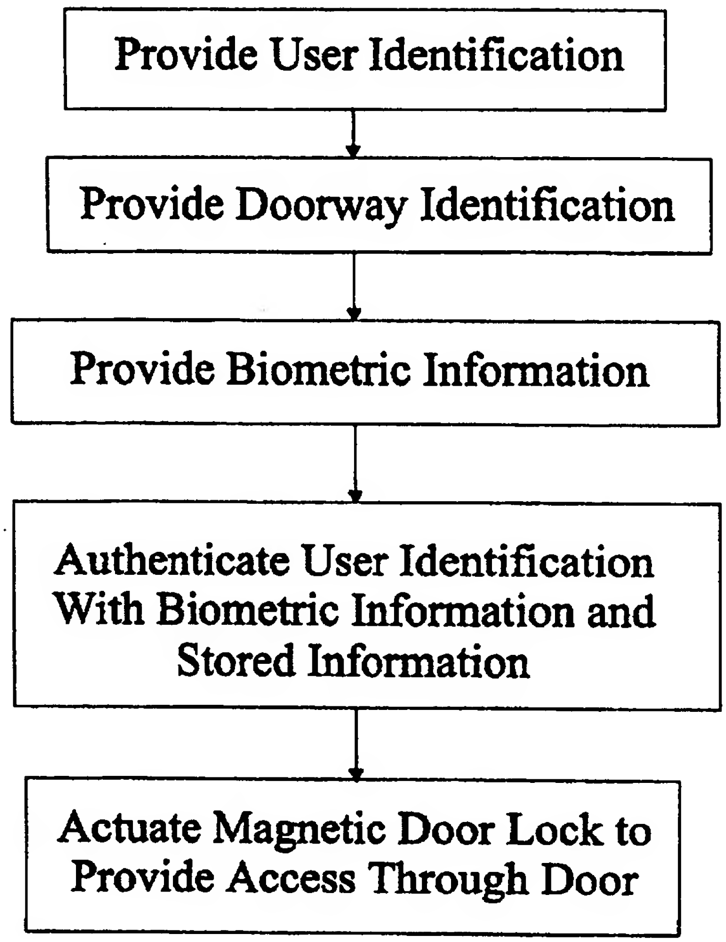
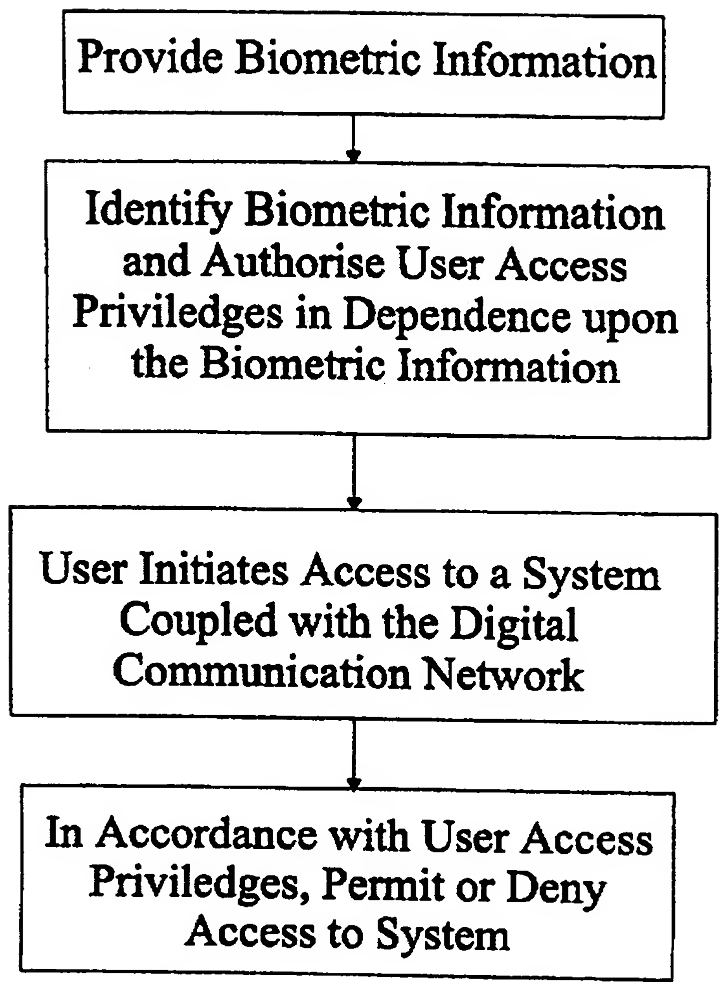
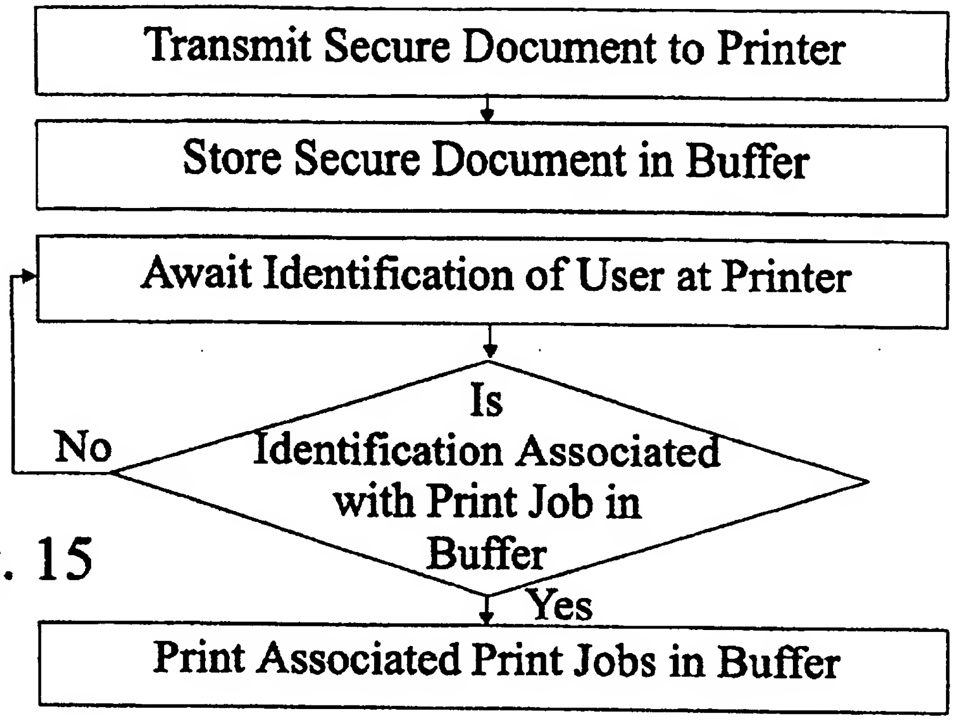

Provide User Identification
Provide Doorway Identification
Provide Biometric Information
Authenticate User Identification With Biometric Information and Stored Information
Actuate Magnetic Door Lock to Provide Access Through Door

Fig. 14


Provide Biometric Information
Identify Biometric Information and Authorise User Access Priviledges in Dependence upon the Biometric Information
User Initiates Access to a System Coupled with the Digital Communication Network
In Accordance with User Access Priviledges, Permit or Deny Access to System


Transmit Secure Document to Printer
Store Secure Document in Buffer
Await Identification of User at Printer
Is Identification Associated with Print Job in Buffer
No
Yes
Print Associated Print Jobs in Buffer
Fig. 15

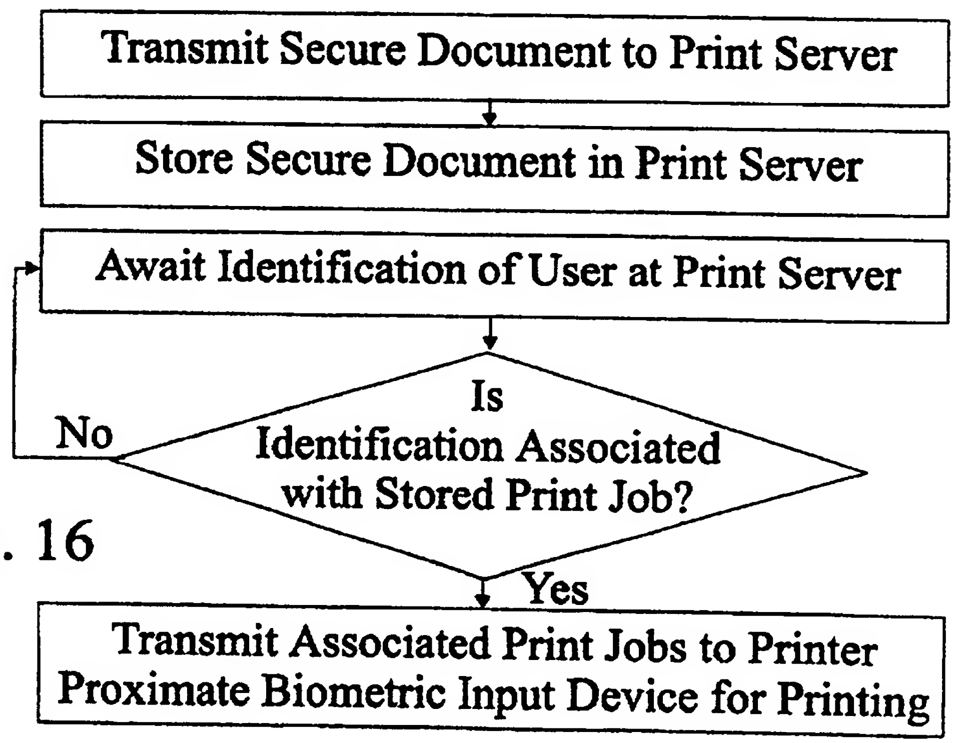
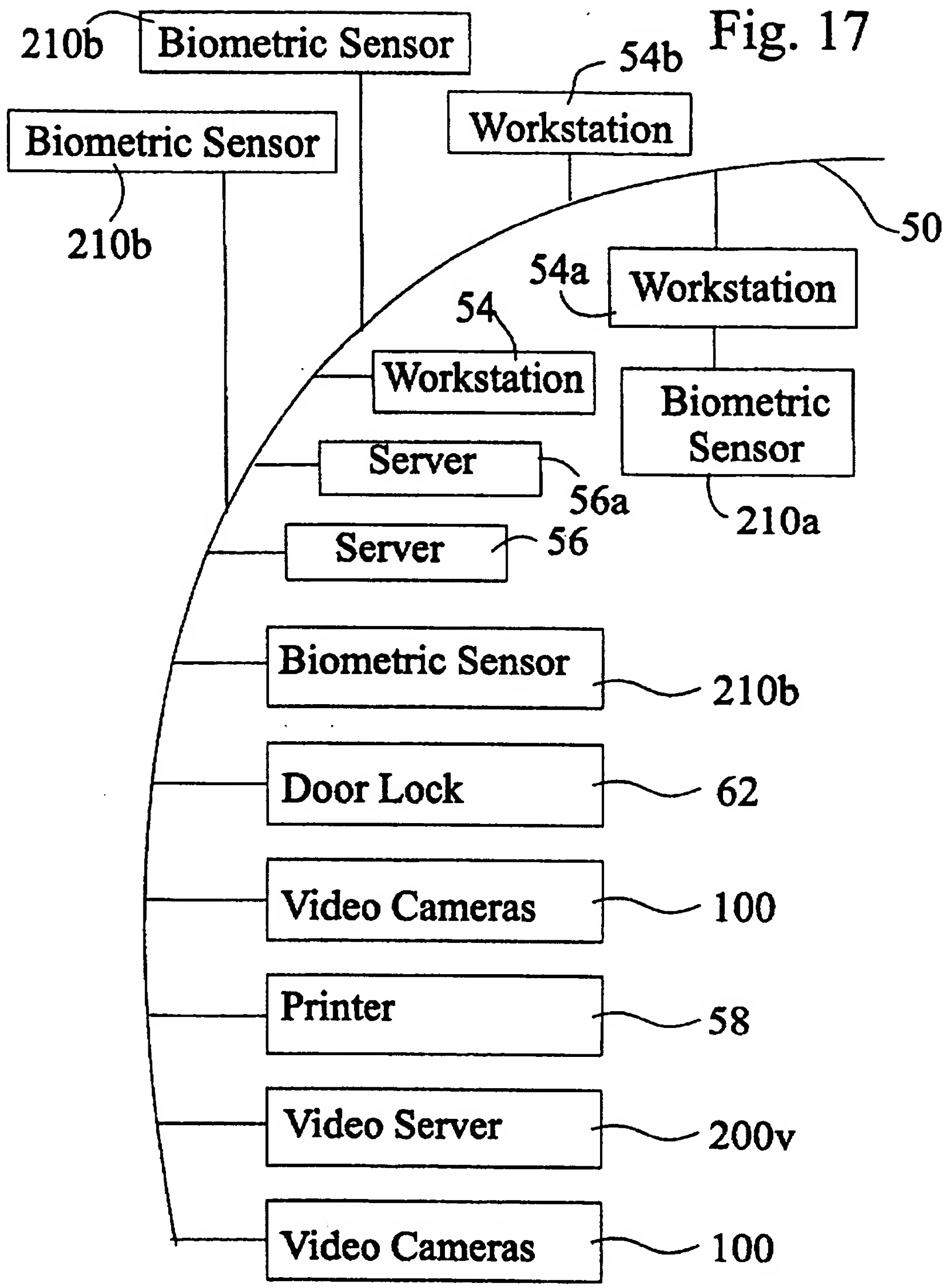

Transmit Secure Document to Print Server
Store Secure Document in Print Server
Await Identification of User at Print Server
Is Identification Associated with Stored Print Job?
No
Yes
Transmit Associated Print Jobs to Printer Proximate Biometric Input Device for Printing
Fig. 16

Fig. 17



210b
Biometric Sensor
54b
Workstation
Biometric Sensor
210b
50
54a
Workstation
54
Workstation
Biometric Sensor
Server
56a
210a
Server
56
Biometric Sensor
210b
Door Lock
62
Video Cameras
100
Printer
58
Video Server
200v
Video Cameras
100

Fig. 18

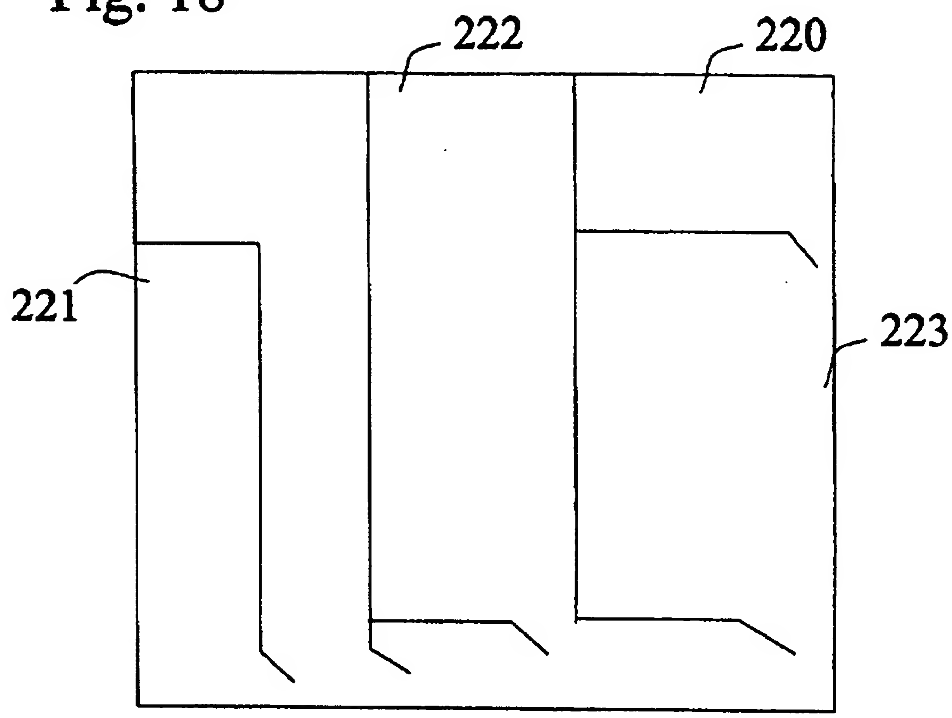


Fig. 19

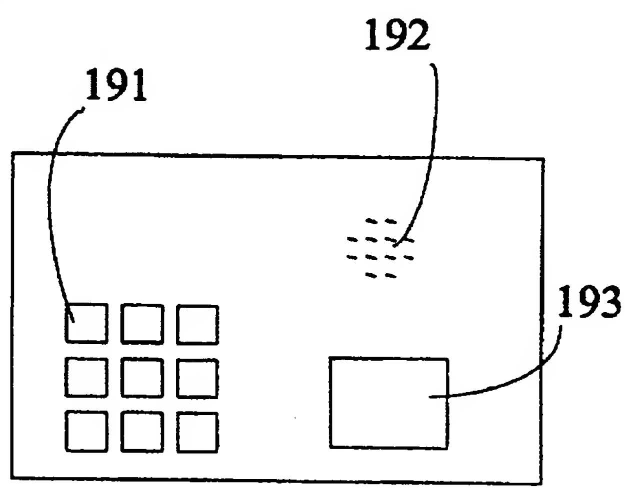


Fig. 20

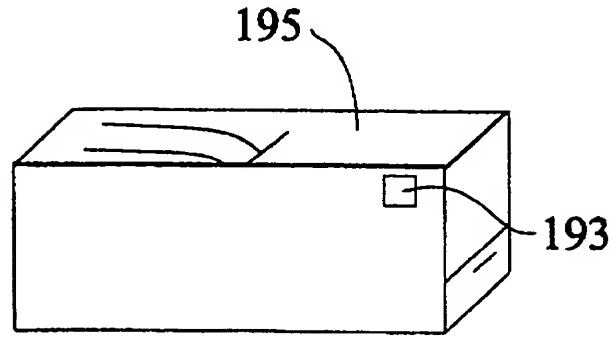


Fig. 21